

REMARKS

The Office Action rejected Claims 1, 2, 5-7, and 9. The Examiner is thanked for identifying Claims 3 and 10 as directed to allowable subject matter.

Claims 1, 2, 5-7 and 9 were again rejected under 35 U.S.C. §103(a) as allegedly obvious over U.S. Patent No. 5,966,942 to Mitchell (hereinafter "Mitchell") in view of U.S. Patent No. 6,256,998 to Gao (hereinafter "Gao").

Claim 1 has been amended to include that the rectified flow can be used to cool the warm ends of the pulse tubes, heat exchangers 117 and 119. Applicants have added this claim to show that the rectification circuit of the present invention provides the cooling. Support for this claim is found in the present specification at [0018] and FIG. 1. No new matter is added via this Amendment. Claim 1 is also amended herein to clarify that all of the flow that enters the buffer volume flows through it. Support for this Amendment is found in the specification where all of the figures show an inlet and an outlet in the buffer volume so that gas can flow through it and the use of the term "passive". Additionally, unlike the present invention which is clearly "passive", see [0009], "passive orifices...through which gas flows....Advantage is taken of this gas flow....by adding check valves...and the gas may flow through the buffer volume, rather than simply flow in and out of the buffer volume", Gao instead is directed to "active phase shifting valves" as described at column 1, line 59. Therefore, in the present invention, all of the gas flows in one direction through the buffer volume. No new matter is added via this Amendment.

The Examiner has acknowledged that Mitchell does not disclose using a multiple stage pulse tube and valves to control the phasing of the working gas but has taken the position that Gao shows these features to be old in the pulse tube art. The Examiner states it would have been obvious to modify Mitchell by using a two stage pulse tube in order to achieve a lower

temperature and to use valves to control the phasing to achieve the lower temperature efficiently and controllably.

According to the Examiner, it is unclear where it is claimed in the present invention that all the gas circulates in one direction. Further, the Examiner states that Mitchell provides circulating flow and rectification which is all that is required in Claim 1 plus a cooling means. The Examiner further states that the water jacket of Mitchell provides a cooling means.

Applicant respectfully traverses this rejection.

The present invention solves a particular problem with GM refrigerators as described at [0005], "Separating the hot end of the pulse tube from the valve introduces the problem of removing the heat from the hot end of the pulse tube when it is remote from the valve". Also at [0008] wherein it states that the present invention solves the problem involved in cooling of cryopumps by GM type pulse tube refrigerators when heat has to be transferred from the pulse tube to a remote sink.

Neither Mitchell nor Gao address nor solve this problem.

In Mitchell, gas flows in and out of the buffer volume and most, but not all, of the gas circulates through separate tubes between the warm end of the pulse tube and the buffer volume. Mitchell teaches a dissipative heat-transfer loop containing one or more fluidic diodes that convert some of the oscillatory power in the oscillating wave into circulating flow of the working gas around the loop. The design of Mitchell for oscillating-wave engines and refrigerators requires the heat exchangers to be located close to one another or massively parallel heat-exchanger structures. Unlike Mitchell, the present invention solves the problem involved in cooling of cryopumps by GM type pulse tube refrigerators when heat has to be transferred from

the pulse tube to a remote sink. Therefore, Mitchell teaches away from the present invention and such teaching away is indicative of non-obviousness.

Mitchell is a vortex device. Trying to adapt Mitchell as suggest by the Examiner, will lead to an inoperative machine. Additionally, in Mitchell, unlike the present invention, the gas does not all flow through the vortex diodes in only one direction. As stated at column 8, lines 32-34 of Mitchell, the diodes "resist flow through it" but do not block flow in the reverse direction. Inasmuch as portion of the gas flows back whereas in the present invention, circulation of all the gas is in one direction through the buffer volume, Claims 1 and 2 of the present invention cannot be rendered obvious by the Mitchell reference. Again, Mitchell and Gao, both alone and in combination teach away from the present invention and teach away from the combination with each other, and such teaching away is probative of non-obviousness.

The Examiner agrees that Mitchell does not use the rectification circuit to cool the hot end of a pulse tube but then states that the claims of the present invention do not claim that the rectification circuit provides the cooling, only that a cooling means is included.

Applicants respectfully disagree with the Examiner that the present invention does not claim that the rectification circuit provides the cooling. The Examiner is referred to paragraphs [0018], [0025] and Figs. 1-4. Others have failed to solve the particular problem which the present invention addresses. Applicants submit that the Examiner has not looked at the invention as a whole in the context of the field in making the obviousness determination. Moreover, the gap between the claimed invention and the Mitchell reference is too wide for a person of ordinary skill in the art to conceive the invention without undue experimentation.

Applicants point out that Gao and the present invention are commonly owned. Additionally, Gao does not solve the problem of removing heat from the hot end of the pulse

tube when it is remote from the valve. This is accomplished via a passive rectification circuit with check valves. The valves of Gao solve a different problem, that is identified at column 1, lines 41-45, as "...to provide an improved two-stage pulse tube refrigerator which has higher overall efficacy at a higher temperature stage, and higher regenerator performance at a lower temperature stage, and less phase interaction losses."

Nothing in the references alone or together suggests the solution to the present problem. Moreover, the combination of Mitchell and Gao does not make the present invention obvious. Nor has the Examiner cited an appropriate motivation to combine these references to arrive at the present invention. Here, the Examiner has relied on hindsight to arrive at the determination of obviousness. It is impermissible to use the claimed invention as a "template" to piece together the teachings of the prior art so that the claimed invention is rendered obvious. *See In re Fine*, 837 F.2d 1071, 1075, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988) (stating "one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to deprecate the claimed invention").

For the foregoing reasons, Applicant submits that the present invention overcomes all the rejections in the Final Office Action and the claimed subject matter is patentable. A Notice of Allowance is respectfully requested.

In the event of any outstanding matters which might be settled by telephone, the Examiner is requested to contact the undersigned Applicants' authorized representative.

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